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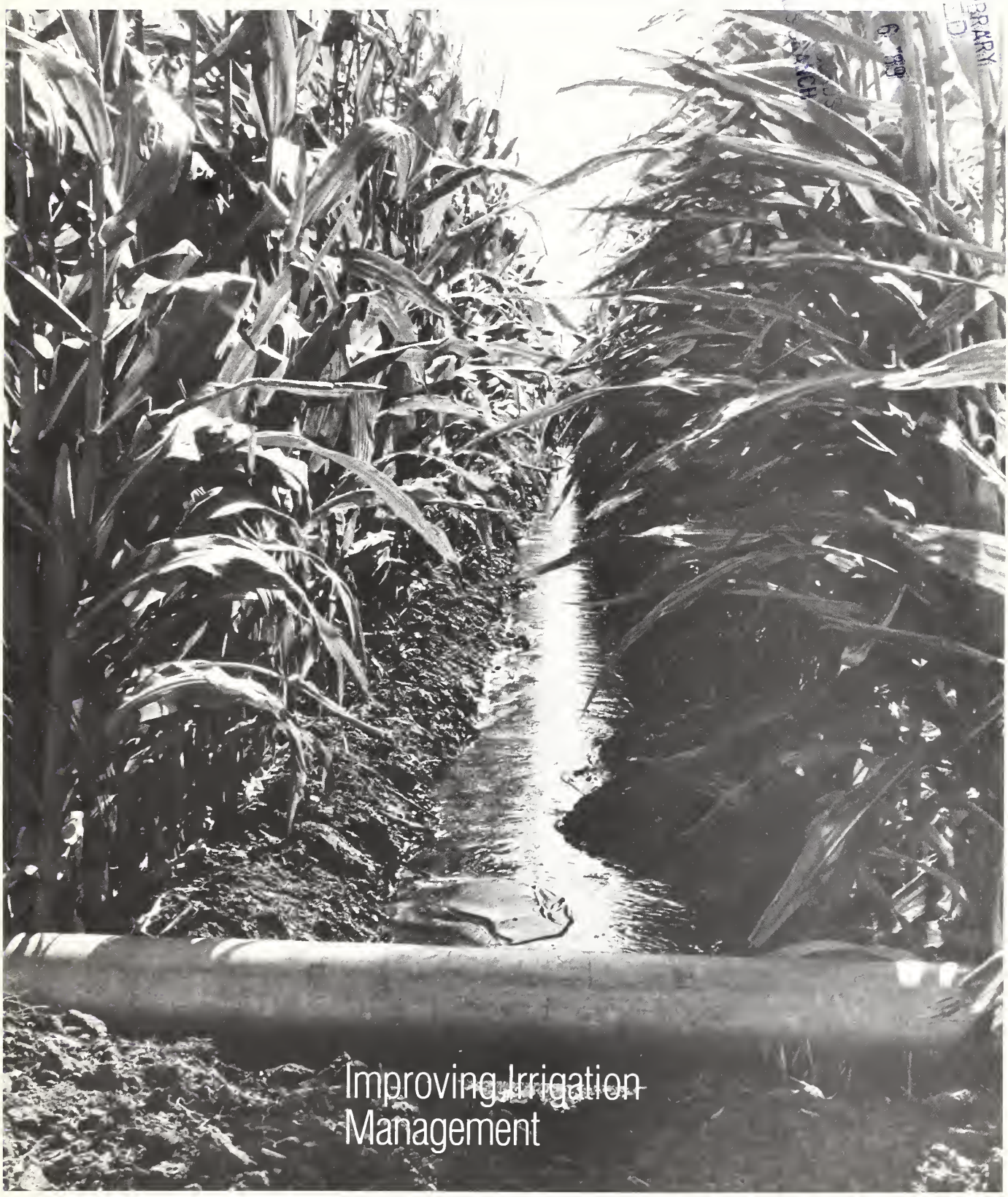

Improving Irrigation Management

Cover: Furrow-irrigated corn on the Texas High Plains. (Photo by Don Comis.)

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Comments from the SCS Chief:

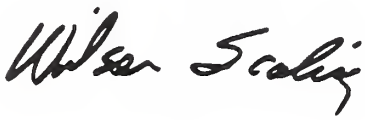
Using Less Water and Irrigating Better

WITH THE RECENT DROUGHT, it is now more important than ever that water be used wisely at the farm level, especially in irrigated agriculture.

Well designed and managed irrigation systems not only conserve water and improve yields but can also protect water quality. Helping farmers to plan, design, and manage their irrigation systems helps them to maintain yields and protect soil and water resources.

All around the country, the Soil Conservation Service is cooperating with conservation districts and other local, State, and Federal agencies to help farmers improve their irrigation systems and manage them wisely.

This includes some commonsense things like installing water meters to measure the amount of water being applied or the use of soil moisture monitoring devices. These help to estimate the efficiency of an irrigation system and help to determine where improvements need to be made. Training for SCS field staffs ensures that SCS continues to provide water users with sound advice. Irrigation Training Modules are being developed for use by field staffs, and workshops are being offered early in fiscal year 1989 to introduce a new irrigation scheduling software program. Better irrigation scheduling can save energy, conserve soil and water resources, and increase yields.



Growing More Rice With Less Water

"AS THE WATER goes, so goes the rice industry," said James Stansel, resident director of the Texas A&M University's Agricultural Experiment Station at Beaumont. Today, using up to 20 percent of the State's renewable water resources, the rice industry is in direct competition with a growing number of urban and industrial water users.

Competition for water and increasing pumping costs could have meant the permanent decline of the rice industry in the Texas Rice Belt in the Upper Gulf Coast region. But, thanks to efforts begun in 1982 by rice producers through the Texas Rice Research Foundation, in cooperation with the Texas Agricultural Experiment Station (TAES) system, the Soil Conservation Service, and local soil and water conservation districts, the future of rice production in Texas is beginning to look brighter. Rice growers are using less water, getting higher yields, and paying lower production costs.

In 1983, the Agricultural Experiment Station at Beaumont released Lemont, a semidwarf, early maturing, long-grain rice variety. Lemont and two other semidwarf varieties released later require less water than traditional varieties to achieve maximum yield. In other words, the semidwarf varieties come with a built-in incentive to conserve water.

At center of photo, Garry McCauley, associate professor and water management specialist at the Agricultural Experiment Station at Beaumont, Tex., explains automated monitoring of water level at gated levee box during a water management tour this summer.

They are concentrating on ways to improve shallow water management and water delivery.

Although the new semidwarf varieties can produce yields significantly higher than traditional rice varieties, for optimum production they require a high level of management. To help producers adjust their management to achieve optimum yields, Garry McCauley, TAES associate professor and water management specialist at Beaumont, Tex.; Ronnie Skala, SCS irrigation water management engineer at Victoria, Tex.; and Gerald Crenwelge, SCS soil scientist at Beaumont, Tex., are cooperating on a study of several rice operations in the area and developing a data base on irrigation water management and use. They are concentrating on ways to improve shallow water management and water delivery.

Their goal is to develop guidelines that will help producers save water and lower their current production costs of $9.41 per hundred weight to world market levels of $5.50 per hundred weight by 1991.

Recommendations for improving water delivery include installing multiple inlets; maintaining delivery canals and laterals; installing underground pipelines for water delivery; using flowmeters to measure inflow; and keeping pumping plants operating at peak efficiency.

Recommendations for shallow water management include reducing levee spacing; laying out levees with precision leveling; using water leveling to check for high or low spots in a field; using a continuous flood instead of frequent flushings; and keeping accurate field records.

Automatic levee gate that controls water level in irrigated border on monitored rice field. The automatic gate is designed to maintain the correct level of water in each border, or cut, despite fluctuations caused by evaporation, percolation, and evapotranspiration. (See "New Valve to improve Rice Irrigation," page 6, August 1987, *Soil and Water Conservation News.*)

Some producers using multiple inlets for water delivery, smaller and closer levees, shallow water management, and smaller fields for more precise management are seeing water savings of 25 percent or more. These practices combined with the new semidwarf rice varieties are helping farmers in the Texas Rice Belt to grow more rice with less water.

Nancy M. Garlitz, Editor, *Soil and Water Conservation News*, SCS, Washington, D.C.

This information supplies the answer to two important questions asked by irrigators, "When do I irrigate?" and "How much water should I apply?"

New Irrigation Scheduling Program Available

John Barclay, SCS district conservationist and irrigation water management specialist, checks operation of an automatic weather station in St. Joseph County, Mich. A computer used for scheduling irrigation calls the station every day for local weather data.

THE SOIL CONSERVATION Service will have a computerized irrigation scheduling program available in October 1988. The program will allow farmers to schedule irrigation of individual fields considering crops, soils, and management objectives.

The program can predict crop water use up to 2 weeks in advance based on historical weather data. This information supplies the answer to two important questions asked by irrigators, "When do I irrigate?" and "How much water should I apply?"

The program was developed and tested by Michigan State University, the Cooperative Extension Service, the St. Joseph County Soil Conservation District, and SCS. The irrigation scheduling program was field tested for 3 years in St. Joseph County, Mich., and was expanded to 14 more counties in Michigan this year.

The computer contacts an automated local weather station daily to obtain data for calculating crop evapotranspiration (ET) for the previous day. To maintain a current moisture budget, the daily crop use is subtracted from the available soil moisture.

The computer program can be verified by comparing its calculations with a neutron soil moisture gauge that determines the actual soil moisture in the field. Adjustments of crop coefficients and soil water-holding capacities are made to improve the program and adapt it to local conditions. The program allows the choice of several ET models for estimating daily, monthly, or seasonal crop water use.

SCS personnel are working with farmers to adapt the computer program to their own operations. Once established, farmers will be able to operate their specific programs with limited technical assistance. Better irrigation scheduling can save energy, conserve soil and water resources, and increase crop yields.

Three-day training sessions for SCS personnel will be held in Pennsylvania, Texas, Arizona, Oregon, Nebraska, and Michigan from November through March.

Classes will be conducted by a team from Michigan State University and SCS. After completing the course on program features and computer operation, participants will be able to prepare individual farm irrigation schedules and train others to operate and adapt the program to local conditions.

Gylan L. Dickey, irrigation engineer, SCS, Midwest National Technical Center, Lincoln, Nebr.

Water Project Goes to Expo

IN THE SUMMER of 1980, in Jackson County, Ark., farmers were lowering the pumps in their wells up to 70 feet to keep from running out of water. That same summer, talk at the local conservation district board meeting centered on how to keep the situation from worsening.

The conservation district board asked the Soil Conservation Service and the Arkansas Soil and Water Conservation Commission to help develop a plan for preventing further depletion of the water table. The planned project, which called for the cooperation of Federal, State, and local agencies and would benefit 26 east Arkansas counties, received Federal funding in 1984.

Today, more than 400 wells across 26 counties are being monitored two times a year to gather data on ground water levels. The wells were chosen based on their location in relation to underground aquifers. The U.S. Geological Survey (USGS) is using the data gathered in developing a computer model that can be used to predict the effect of various pumping strategies, irrigation methods, and cropping patterns on ground water levels.

Special studies are also being conducted to determine the most efficient irrigation methods and systems. Taken into account are soil characteristics such as water holding capacity and infiltration rates. Water quality and long-term soil effects are also being monitored, especially for salinity.

From the well monitoring and special studies, area farmers are being provided information on the amount of water needed to make a crop; how much the water costs; their well efficiency; and the amount of water wasted by their current irrigation systems.

The accomplishments of the East Arkansas Water Conservation Project went on display this July at the 4-day National Water Management Expo in North Little Rock, Ark. The expo included seminars and field tours on improved irrigation methods, ground water management, and soil characteristics.

Other sponsors of the project and expo, in addition to the Jackson County Conservation District and other local conservation districts, the Arkansas Soil and Water Conservation Commission, USGS, and SCS, were the Arkansas Association of Conservation Districts, the University of Arkansas at Fayetteville and Pine Bluff, and the Cooperative Extension Service.

Susie Harris, public affairs specialist, SCS, Little Rock, Ark.

Participants at 1988 National Water Management Expo discuss evaluation procedure for center-pivot sprinkler irrigation systems. The Expo showcased many of the results of the 26-county East Arkansas Water Conservation Project.

Quality and Quantity

Cleaner Water, More Rice

ROSS PEARSON OF Colusa County, Calif., has a lifetime of experience growing rice, and he believes that traditional rice irrigation systems are no longer needed. Pearson's practice is simpler–with no continuous circulation, no sump, and no pump. His rice fields are separate from each other, with no irrigation gates in the dikes between them.

Fields receive water through pipes from a common supply ditch, but the ditch itself is intersected by dikes with water control devices. "By regulating the amount of water in each section of the supply ditch, I can control the amount of water on the field that needs irrigation, and there is no overflow," said Pearson. "The system uses less water, and I can flood all of my fields at the same time."

The field side of the inlet pipes has an outward opening flap which allows the field to be flooded, but prevents the herbicide-bearing field water from flowing back into the supply ditch.

Pearson said, "The original purpose of the field-to-field series irrigation method may have been to flush alkali and salt from the field, but today most of the fields no longer require continuous water circulation. This circulation is not only unnecessary, but also lowers productivity."

The large strips of unripened, green grain common with conventional irrigation do not appear in Pearson's fields. Depending on field configuration, Pearson's approach may substantially reduce the cost of constructing a herbicide control system for tailwater on rice.

Pearson's method has been accepted in specified areas of California for Agricultural Stabilization and Conservation Service (ASCS) cost sharing. Under 1988 regulations, ASCS will pay from 50 to 75 percent of the cost of the system.

John Tiedeman, agricultural engineer, SCS, Colusa, Calif.

Irrigation Wells Tested for Agrichemicals

THE HIGH PLAINS Underground Water Conservation District No. 1 in northwestern Texas is testing irrigation wells to determine if herbicides and pesticides are leaching into the Ogallala Aquifer in the South High Plains. Some 8.5 million acres of the aquifer, which runs north-south through the State, lie within the water district. Average depth from land to water is 150 feet.

The water district is collecting samples from 90 private wells within the 15-county area it serves, said Manager Wayne Wyatt. Based on the results of a questionnaire distributed by the water district, 31 composite samples will be analyzed for residue of 19 agrichemicals farmers reported using. In the questionnaire, farmers identified specific chemicals and when they used them.

Wyatt said the water district began collecting the samples in July and expects to finish by September. Results are expected by the end of September. If contamination is found, additional samples will be collected and analyzed. Project cost to the district is $56,000.

Nationally, the Environmental Protection Agency (EPA) is checking wells for pesticide and fertilizer contamination of ground water. EPA has begun a survey to look for more than 100 agricultural pesticides in 1,350 private and community wells supplying drinking water. The agency is also looking into fertilizer contamination.

A USDA study last year showed 20 percent of the Nation's wells may be contaminated by pesticides, with the most widespread contamination occurring in the northern Corn Belt. About 60 of the chemicals cited in the study can potentially contaminate water.

SWAP Team Invades Groves

THE INDIAN RIVER and St. Lucie Soil and Water Conservation Districts on Florida's east coast are cooperating to help citrus growers make their present irrigation systems more efficient. The joint effort–called Soil & Water Action Project (SWAP)–uses water table stage recorders and neutron moisture gauges to examine water table dynamics, root zone saturation, and plant bed saturation.

Although low-volume trickle irrigation has gained in popularity, about half of the 145,000 acres of citrus planted on beds in the two counties are irrigated by a high-volume method called crown flood. Crown flood irrigation is usually inefficient, with most of the ground water running off into a canal.

The Soil Conservation Service and district staff are using SWAP information to convince citrus producers to refine their crown flood irrigation scheduling techniques, and the SWAP team is beginning to get converts.

Jimmy Simpson, production manager for the Packers of Indian River Citrus Company, who is responsible for 1,200 acres of citrus in the two counties, is a good example. He now uses water table observation wells made from PVC pipe installed at the treeline in conjunction with a "Days-to-Delay Irrigation" table based on water table levels, soil type, bed dimensions, and month. Also taken into account are rainfall and soil moisture.

Simpson's goal is not to allow the available water in the root zone to be depleted more than the recommended 30 percent between January and July and 50 percent between August and December. To accomplish this, he crown flood irrigates when it is time, but now only allows the water level to be lowered to what the table recommends instead of allowing all the water to flow out of the grove.

Simpson feels this is helping his trees because they never go into stress. At the same time, it helps to save water because less water is needed to fill the furrows when it is time to irrigate again. In fact, roughly 180,000 gallons/acre/ year can be saved, which amounts to about 14.5 million gallons in a typical 80-acre citrus grove.

SWAP studies are continuing, as is the drive for improved crop response and water conservation.

Clare Nichols, soil conservationist, SCS, Vero Beach, Fla.

Jimmy Simpson, production manager of The Packers of Indian River Citrus Company, checks soil moisture in the root zone .

New System Yields More, Better Crops

"I CAN IRRIGATE at least four times as many acres during the middle of the summer, and the crops are uniform from the top of my field to the bottom," said Allen Dalley, of Iron County, Utah.

Dalley, and other farmers in the county are reaping the benefits of the newly completed Summit Farm irrigation project.

The new system, operated by gravity pressure, consists of a sluicing structure to clean up the water, a storage reservoir, 8.7 miles of high pressure pipeline, and moveable sprinkler lines. All of the water entering the new conveyance system will now reach the field. This dependable water supply enables farmers to increase the quality and quantity of their crops and net a greater profit.

The old system would only irrigate 196 acres of cropland. The new irrigation system provides enough water for more than 800 acres. Another 450 acres should receive a partial supply of water from snowmelt and rainfall.

Funding for the irrigation system in the amount of $350,000 was provided by the Color County Resource Conservation and Development (RC&D) Area and Utah State Division of Water Resources. The project was sponsored by the Summit Irrigation Company, the E&I Soil Conserva-

Saves Water, Helps Crops

tion District, and the Utah State Soil Conservation Commission with technical assistance from the Soil Conservation Service.

The water was available, but getting it to the cropland was the problem. More than 50 percent of the available water was lost during delivery to farms through seepage, excessive use by vegetation on ditch banks, and leaky water control structures.

The project area covers 1,600 acres, which includes the town of Summit and surrounding farmland. "I planted 25 acres of new hay and will plant 50 acres of wheat," said Carlisle Hulet, one of the 27 farmers in the project area. "It is really a good project, and provides water to every stockholder's land. Everyone has plenty of water pressure," he said.

Howard Roper, soil conservationist from the SCS field office in Cedar City, visits farmers in the project area each week to provide irrigation water management assistance. "Expanding the number of acres irrigated brings with it the responsibility of proper water management," Roper said. "Knowing when to water and how much to apply increases production and profits while conserving soil and water resources."

Wray Macy, RC&D coordinator, SCS, Cedar City, Utah

An Open & Closed Case For Irrigation Systems

MORE AND MORE Collier County vegetable farmers in southwest Florida are switching from a traditional open-ditch irrigation system to a semiclosed system which uses pipe to deliver water to 8-inch-deep furrows.

By eliminating the need for large ditches and roadways, the semiclosed system can increase acreage available for production by 10 to 20 percent. Also, harvesting and spraying equipment can more easily straddle the smaller irrigation furrows.

The semiclosed system has other advantages over the open-ditch system. Water savings can be great. In one study conducted in Collier County, the semiclosed irrigation system required only one-third the daily water required by the open-ditch system.

Land in Collier County is flat. Therefore, slight slopes are added to vegetable fields with semiclosed irrigation systems to allow excess rainfall to run off into a rim ditch. In contrast, with an open-ditch system, rainfall, and often irrigation water, needs to be pumped off fields to prevent flooding.

With the semiclosed system, monitoring wells allow observers to note when evapotranspiration pulls the water table down to 24 to 26 inches. Pumps are then turned on and water is delivered to the furrows via pipeline until the water table rises to the 14- to -16 inch level. This way, irrigation timing is determined by the rate of evapotranspiration and not by an arbitrary day-and-hour schedule as with the open-ditch system.

Data collection in Collier County will continue for further comparison of results under different irrigation management techniques.

LeRoy Crockett, soil conservationist, SCS, Immokalee, Fla.

Lining Furrows With Straw

RESEARCH IN THE Pacific Northwest shows that straw mulching in irrigation furrows conserves water and improves crop yields.

At the U.S. Department of Agriculture Agricultural Research Service's (ARS) River Conservation Center in Kimberly, Idaho, grain straw spread in irrigation furrows improved soil water intake, reduced irrigation time, and increased yields. One pound of straw applied to a 100-foot bean furrow reduced by 50 percent the time required for irrigation water to soak between rows. Strawed furrows produced 61 percent higher bean yields than nonstrawed furrows.

The trick was to dissipate the destructive energy of the fast-moving water while still receiving the benefits of irrigation.

On a larger scale, applying 500 to 700 pounds of wheat straw per acre brought similar results at the ARS Columbia Basin Research Center in Prosser, Wash. Researchers also found significant increases in the accumulation of water in strawed areas.

At the Malheur Experiment Station in Ontario, Oreg., strawed furrows also held water longer than nonstrawed furrows. Water intake increased 50 percent. And sugar beets grown in strawed furrows brought 20 percent higher beet yields and 25 percent greater sugar yields than nonstrawed furrows.

Conservation tillage can be used to maintain crop residue on the soil surface. On clean-tilled fields, straw can be placed by hand. On large fields, mulching is simplified by commercially available machines that distribute straw from hay bales placed along furrows.

Since crop residue on the soil increases infiltration, time settings of irrigation equipment must be changed as soon as the desired amount of soaking occurs. Equipment left on time settings used before practicing straw mulching causes overirrigation and wastes valuable irrigation water.

Floyd G. Bailey, State conservation agronomist, SCS, Boise, Idaho.

Structure Slows Water, Saves Money

CLIFFORD PARSONS, Soil Conservation Service area engineering specialist, now retired, met the challenge: How to control the high soil-eroding velocity of irrigation water discharged into leveled basins in the Wellton-Mohawk Valley of Arizona.

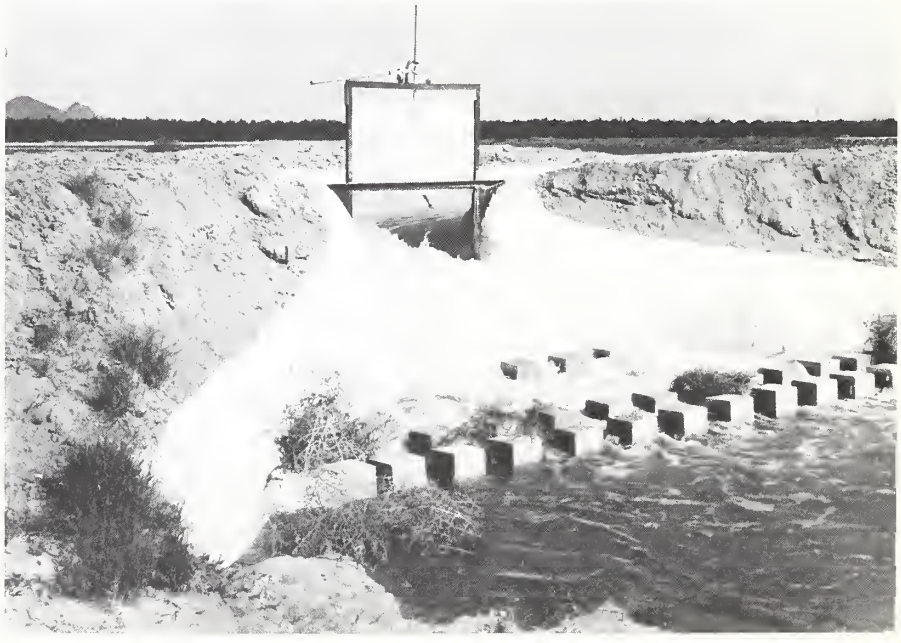
Discharges up to 30 cubic feet per second are applied to the irrigated land washing away large amounts of topsoil in the process, sometimes creating scour holes large enough to bury a tractor. The trick was to dissipate the destructive energy of the fast-moving water while still receiving the benefits of irrigation.

While improvising in the field, Parsons came upon a solution. By using a uniformly spaced row of cinder blocks in front of a downstream sill to direct flow and a short row of blocks located just upstream near the structure's inlet to dissipate the water's energy, he was able to control and distribute the flow.

Benefits of this large field turnout structure include reduced irrigation labor, savings in soil erosion and maintenance of scoured holes, and the flexibility to control a variable flow rate. In Arizona, savings in reduced labor, erosion, and water costs are estimated at $10 million over the past 12 years.

Over 5,000 of the structures have been installed in the Wellton-Mohawk Valley at an installation cost of about $4 million.

Ralph M. Arrington, State conservation engineer, SCS, Phoenix, Ariz.



Rows of cinder blocks safely slow irrigation water being applied to a leveled basin in the Wellton-Mohawk Valley of Arizona.

NEWS Briefs

Egyptians Go to The Field

IN THE WEST and Midwest this summer, 13 Egyptian engineers helped Soil Conservation Service personnel set flumes to measure waterflow in furrow irrigation systems, collect water samples for laboratory analysis, develop conservation plans, conduct soil surveys, design irrigation systems, and inspect completed conservation work.

The engineers were from the Egyptian Ministry of Irrigation and attended the SCS Irrigation Water Management (IWM) Workshop in Salt Lake City, Utah, the first week of June. They then spent 3 weeks studying SCS field operations in Utah, Colorado, Arizona, Kansas, and Idaho. Their training was funded by the United States Agency for International Development.

Also attending the workshop were SCS technical personnel from several States, including soil scientists, technicians, soil conservationists, and engineers. Students evaluated irrigation systems in the field and analyzed ways to present results to farm operators.

During their visit, the Egyptian engineers talked to representatives of local soil and water districts and Federal agricultural agencies in the States.

Swayne Scott, national irrigation engineer, SCS, Washington, D.C.

Touring SCS field operations, interpreter Ragy Darwish (left) and engineers Abdalla Haliem (center) and Hamdi Hadila (right) core a hole for an irrigation access tube on a Kansas farm. The engineers were members of a group from the Egyptian Ministry of Irrigation.

Irrigators Learn To Cut Costs

BY TAKING THE advice of experts, Idaho's irrigators do more than keep their heads above water; they learn how to keep rising energy costs under control.

Idaho's irrigators face a major energy crisis. A doubling of energy costs over the past decade has driven up the price of delivering water to crops. To compensate for these higher costs, irrigators attend seminars during the winter and spring to learn how to cut energy expenses during the growing season.

For the past several years, the 1-day seminars sponsored by the Cooperative Extension Service, the Idaho Department of Water Resources, and the Soil Conservation Service advised irrigators and farmers about irrigation and energy use. Private consultants, public utilities, and irrigation dealers and suppliers help to conduct the seminars.

To cut energy costs, the team of experts suggests replacing inefficient surface irrigation systems with sprinkler systems and using laser-controlled land leveling to establish borders and furrows. To aid irrigation scheduling, soil moisture monitoring devices and site-specific weather stations are being installed.

Many attendees put their training into practice. One farmer realized a 50-fold increase in energy savings. Most others receive paybacks in 3 to 5 years. On many farms, crops improved in quality and quantity.

Neil D. Wilton, irrigation engineer, SCS, Boise, Idaho.

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Texas Irrigators Save Water and Money

TEXAS FARMERS and ranchers are saving about 6.4 billion gallons of water a year as a result of a 2-year-old program initiated by the Texas Water Development Board, reports the *Journal of Soil and Water Conservation.*

The program offers 75 percent matching grants to underground and surface water districts and to conservation districts to buy equipment to evaluate and monitor the efficiency of existing irrigation systems. The funds can also be used to demonstrate efficient water conservation systems.

During 1986 and 1987, the board provided $75,236 in matching grants to nine districts providing services on 597 farms and 70,880 irrigated acres, about 1 percent of the total irrigated acres in Texas. The 6.4 billion gallons, or 20,000 acre-feet, amounts to an annual savings to operators of $700,000, assuming that irrigation water pumping costs are $35 per acre-foot, said Comer Tuck, supervisor of the board's Agricultural Conservation Unit.

The board also has developed a free, 16-page booklet, "Conserving Water in Irrigated Agriculture." It explains why water conservation is important in agriculture and describes soil moisture monitoring, irrigation system evaluation, and water-efficient irrigation techniques. The booklet is available from the Texas Water Development Board, Agricultural Conservation Unit, P.O. Drawer 13231, Capitol Station, Austin, Tex. 78711.

Grants Available

DO YOU HAVE an innovative, cost-effective agricultural resource conservation project in need of funds? The National Endowment for Soil and Water Conservation sponsors a grant program to match projects requiring funds with potential funding sources.

The projects should demonstrate good management of soil and water resources and pollution. They should be innovative and deal with serious erosion, water depletion, or pollution problems or cost-effective conservation techniques.

For more information or inquires about grant applications write The National Endowment for Soil and Water Conservation, 318 Fourth Street, N.E., Washington, D.C. 20002 or phone 202-546-7407.

Electronic Level

ACCURACY, DURABILITY, portability, and productivity are the characteristics of a new electronic level that Soil Conservation Service surveyors are using in Missouri.

SCS recently purchased 36 electronic Spectra Physics EL-1 levels to use in the conservation operations program in the State. The electronic levels, which use laser technology, were chosen for their simplicity of operation. The instruments need only to be rough leveled manually and then will level electronically.

Tom Keep, assistant State conservation engineer for SCS, said the main advantage of the electronic level is that only one person is needed to survey with it. The level is battery operated, weighs less than 9 pounds, and produces a consistent 360-degree reference with a range of up to 1,000 feet.